LAB – Comparing Leaf Surface Area: Shade vs. Sun

**Introduction:** Leaves are the main photosynthetic organs of a plant. In this lab activity, you will be measuring the surface area of ivy leaves taken from English ivy (*Hedera helix*) plants growing in two very different light conditions. One condition will be direct sunlight while the other will be shade.

**Research Question:** What is the effect of sunlight exposure (direct sun vs. shade) on the surface area of leaves growing on English Ivy (*Hedera helix*) plants?

- Independent variable (I.V.): ________________________________
- Dependent variable (D.V.): ________________________________

In the space provided, write a **hypothesis** to the research question above. (If… then… because…)

---

**Procedure:**

1) You will be working in groups of 2-3. As a class we will be visiting two sites (shaded and sunny). At each site, your group will collect 1 mature English Ivy leaf as demonstrated by your teacher.

2) Once we are back in the classroom, you will determine the surface area of each leaf using two different methods.

**METHOD 1:**

A) Obtain a piece of graph paper with 1 cm squares. Trace the leaf that was collected in the sunny area on to one half of the graph paper. Next, trace the leaf that was collected in the shaded area on to the other half.

B) **Count** the number of whole square centimeters that are covered by the leaf outline. **Estimate** the area of the partial squares. (Here’s a simple method for this estimate: Count a partial square if it is at least half covered by the leaf; do not count partial squares that are less than half covered.)

**Do not include the area of the stem (petiole) in your calculations.**

C) Record your surface area estimates for each leaf in Table 1. Then record your estimates on the class data table.
Results:

Table 1: Estimated Surface Area of the English Ivy leaf from the sunny & shady sites. (METHOD 1)

<table>
<thead>
<tr>
<th>Individual / Team Result</th>
<th>Sunny Site (cm²)</th>
<th>Shady Site (cm²)</th>
</tr>
</thead>
</table>

METHOD 2:

A) Determine the mass of each leaf (NO stem attached). Record in Table 2.

B) Use a metric ruler to measure 1 cm² of the leaf. Use a knife to cut this square centimeter out.

C) Determine the mass of 1 cm² of each leaf. Record in Table 2.

D) CALCULATE the surface area (cm²) of the entire leaf using the equation below:

\[
\text{SURFACE AREA (cm}^2\text{)} = \frac{\text{mass of entire leaf (g)}}{\text{mass of 1 cm}^2\text{ (g/cm}^2\text{)}}
\]

Table 2: Calculated Surface Area of the English Ivy leaf from sunny & shady sites. (METHOD 2)

<table>
<thead>
<tr>
<th>Mass of entire leaf (g):</th>
<th>Sunny Site (cm²)</th>
<th>Shady Site (cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass of 1 cm² of leaf (g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CALCULATED Surface Area of Leaf**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3: Class Data for English Ivy Surface Area (METHODS 1 & 2)

<table>
<thead>
<tr>
<th>Group Member Initials:</th>
<th>Sunny Site (cm²)</th>
<th>Shady Site (cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>METHOD 1:</td>
<td>METHOD 2:</td>
</tr>
<tr>
<td></td>
<td>Method 1:</td>
<td>Method 2:</td>
</tr>
<tr>
<td></td>
<td>Method 1:</td>
<td>Method 2:</td>
</tr>
<tr>
<td></td>
<td>Method 1:</td>
<td>Method 2:</td>
</tr>
<tr>
<td></td>
<td>Method 1:</td>
<td>Method 2:</td>
</tr>
<tr>
<td></td>
<td>Method 1:</td>
<td>Method 2:</td>
</tr>
</tbody>
</table>

**AVERAGE**

**GRAPH**: Create a bar graph of the class data surface area averages in Table 3 (show averages of BOTH methods!). Make sure to include a key, titled axes and a descriptive title.
**Discussion:**
1) What were your independent and dependent variables?

2) Was your original hypothesis supported or falsified? Explain by stating evidence from your data.

3) What inference(s) can you make from your observations?

4) Why do you think there are various sizes of leaves on a single plant?

5) What did you notice about the thickness of the leaves? Is there any purpose to leaf thickness? Did you notice any difference between the thickness of leaves taken from shaded areas vs. sunny areas?

6) What were some problems you faced with this experiment?

7) Describe at least one way to improve this experiment.

**Conclusion:** Write a short paragraph summing up your findings. Be sure to include your CLAIM, EVIDENCE, and INTERPRETATION!

**CLAIM:**

**EVIDENCE:**

**INTERPRETATION:**